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NEW SPECIES OF *SIPUNCULA* FROM THE
WESTERN NORTH ATLANTIC

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Among the sipunculans collected during the past few years off the east coast of the United States (Emery and Schlee, 1963; Sanders, Hessler and Hampson, 1965; Cutler, 1967) were several new species, four of which are herein described. All of them were small (less than 1 cm) and came from fairly great depths (off the continental shelf).

This work is part of a larger study (Cutler, 1967) which may be referred to for more complete information about the species' distribution. This larger work will be submitted for publication in the near future.

I wish to acknowledge the support of the Cooperative Oceanographic Program of Duke University during part of this work.

***Aspidosiphon zinni* new species**

Diagnosis: A very small *Aspidosiphon* with a fine-grained, ungrooved anal shield from deep water.

Description: Two hundred and forty six specimens from 17 stations.

These worms are small (1-5 mm) and fragile. Most are 2-3.5 mm long by about 0.3 mm in diameter. They are cylindrical and transparent except at the two ends where there is some light brown pigmentation. The introvert is almost equal in length to the trunk and expands near its tip giving it the appearance of a spiked club (Fig. 1A). Commonly, these are found in elongate, arenaceous foraminiferan tests.

The numerous irregularly arranged hooks are single pointed and about 15-20 μ from base to tip (Fig. 1C). No tentacles were observed. The anal shield is yellowish and composed of fine, closely-grouped units giving it a granular appearance (Fig. 1B). This shield is flat and usually set off from the main axis of the trunk by 60 to 90 degrees. The posterior



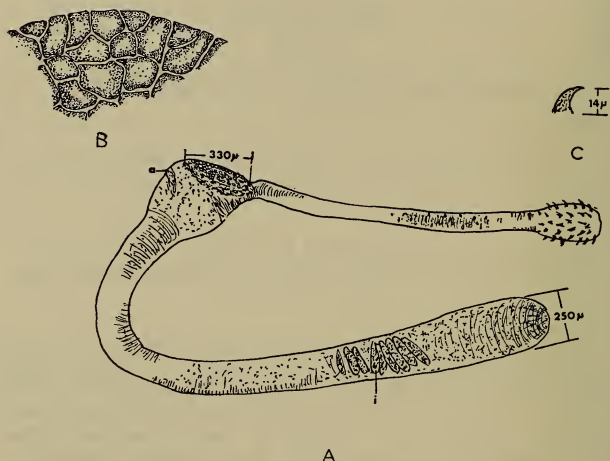


FIGURE 1. Showing *Aspidosiphon zinni*: (A) the entire animal showing anus (a) and intestine (i) through body wall: (B) the enlarged portion of anal shield: (C) an isolated hook from introvert.

shield is very poorly defined, but annular wrinkles or folds are discernible at the posterior end of the trunk.

It is possible to see most of the internal structures through the body wall; however, all attempts at dissection have been unsuccessful. Attempts were made to section the material but these did not yield any useful information other than that the longitudinal muscle layer was continuous. The intestinal coil extends to the posterior end of the trunk and the anus is just behind the anterior shield. The two brown nephridia open at about the level of the anus and are usually less than 25 percent of the trunk length. Two retractors are present and originate near the ventral nerve cord about 65–80 percent of the distance to the posterior end of the trunk.

Remarks: The only other member of this genus thus far reported from similar latitudes is *Aspidosiphon mulleri* Diesing, 1851, and with one exception (Fischer, 1922:22), it seems to be restricted to the eastern side of the Atlantic Ocean. These two species are quite different; *A. mulleri* is generally larger (8–15 mm) with dark brown, more massive, furrowed anal shields. No other species approaches this one in terms of morphology or distribution.

This species has been named for Dr. Donald J. Zinn, Professor of Zoology, University of Rhode Island.



FIGURE 2. Showing *Onchnesoma magnibatha*. An external view showing intestinal coil through transparent body wall.

Distribution: This species is found between 2000 and 3000 m with a few at shallower depths (shallowest 1102 m), generally off the mid-Atlantic States. The temperatures are cold and the sediments are very fine. This is not the typical *Aspidosiphon* habitat.

Holotype: U.S.N.M. 38242; Location 39°26' N, 70°38' W; Depth, 2496 m; Collected 21 August 1964 by Sanders, Hessler and Hampson.

Paratype: U.S.N.M. 38243; on slide; Location 39°42' N, 70°39' W; Depth, 2086 m; Collected 24 May 1963 by Sanders, Hessler and Hampson.

Onchnesoma magnibatha new species

Diagnosis: An *Onchnesoma* with pronounced, continuous posterior ridges and thin, transparent skin from deep, cold water.

Description: Twenty four specimens from 11 stations.

The trunk varies in length from 2.5–6 mm, and in width from 1–2 mm. The shape varies from almost cylindrical to pear-shaped with the posterior end bluntly pointed. The anterior $\frac{1}{4}$ to $\frac{1}{2}$ of the trunk is narrowed to a diameter equal to that of the introvert; only the posterior section is bulbous (Fig. 2).

The skin of the central enlarged portion is very thin, fragile, and transparent, while that of the anterior narrowed part is opaque, somewhat rugose, and pale brown-tan. The posterior end has a series of longitudinal ridges merging at the apex and has a suggestion of the tan coloration. These ridges are more pronounced than in *Onchnesoma steenstrupi* Koren and Danielssen, 1875, and are more continuous *i.e.*, not composed of distinctly separate scales or plates.

The introvert is generally the same diameter as the anterior part of the trunk but somewhat paler; it is smooth and transparent if extended. None of my material is completely extended so I cannot comment on the tentacular arrangement. The introvert appears to be less than twice the length of the trunk and often (measured on dissected, partially contracted specimens) only equal in length to the trunk.

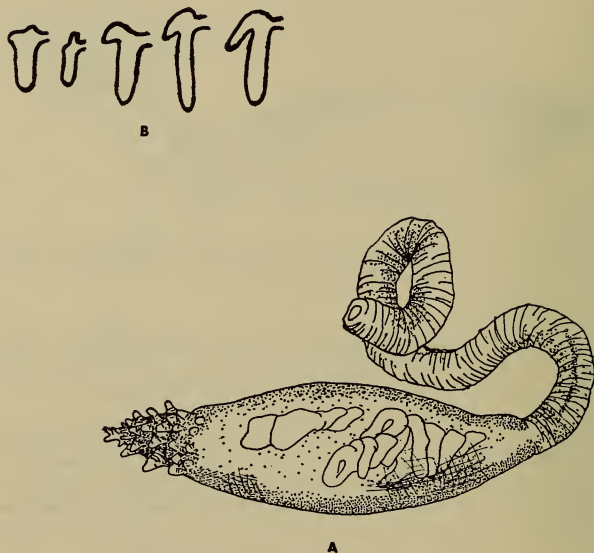


FIGURE 3. Showing *Golfinigia (Mitosisiphon) murinae*. (A) is an external view with intestine showing through body wall. This individual has posterior papillae which are more prominent than some others: (B) shows several nephridia from *G. murinae bilobatae*, with varying degrees of development of second lobe.

The intestine has about 30 double coils; the esophagus and rectum are long; there is one or sometimes two fixing muscles, one attaching the esophagus near the posterior end of the body. The anus is located about 75–80 percent of the distance towards the distal end of the introvert. The single nephridium is on the right side, unpigmented, and unattached to the body wall except at the nephridiopore. The retractor appears single in most contracted specimens, but in one case, there are two distinct roots.

Remarks: This species superficially resembles some members of the genus *Golfinigia* Lankester, 1885, more than the other *Onchnesoma*. There is no question, however, that it does belong to *Onchnesoma*. It has the single retractor, single nephridium, and anteriorly displaced anus. Internally there is not much to distinguish this species from the other two members of the genus, *O. steenstrupi* and *O. squamatum* Koren and Danielssen, 1875. It has none of the large scalelike papillae char-

acteristic of *O. squamatum*, but does somewhat resemble *O. steenstrupi*. It differs from the latter species in having a much shorter introvert; the anus not immediately behind the mouth; a much thinner, transparent skin; posterior ridges more pronounced and continuous; a pair of roots sometimes present on the retractor; and a somewhat different shape and color.

Distribution: *Onchnesoma magnibatha* (as the name implies) has been collected only from great depths, generally between 3750–4980 m off the mid-Atlantic States where the temperatures are stable and cold.

Holotype: U.S.N.M. 38244; Location 33°57' N, 65°47' W; Depth, 4715 m; collected 1 May 1966 by Sanders et al.

Paratypes: U.S.N.M. 38245; Location 00°46' S, 29°28' W; Depth 3459 m; collected 14 February 1967 by Sanders et al.

***Golfingia murinae* new species**

Diagnosis: A *Golfingia* in the subgenus *Mitosiphon* with long, slender introvert, large mammiform papillae on the posterior end of the trunk and hooks with a comblike series of teeth at the base of some of the hooks. May have single or bilobed nephridia.

Description: These worms have trunks 1.5–13 mm. The introvert is at least four to six times the length of the body. They are semi-transparent, yellow, tan, or brown depending on their size and state of contraction. The trunk is generally shaped like a plump spindle with mammiform papillae on the posterior end which are usually very distinct (Fig. 3A). The anterior delineation of the trunk is not always clear as it often tapers gradually into the long, delicate introvert. Small hooks (25–40 μ) are present at the tip of the introvert in a few rows, then becoming sparsely scattered. These hooks just behind the tentacles have an accessory comb of spinelets at the base. These are easily overlooked. The nature of the tentacles can not be ascertained because no specimen is completely expanded. There are small papillae on the remainder of the introvert.

The trunk wall in some specimens is rather thick and the rough, loose-appearing epidermis of some specimens has blister-like papillae. Smaller ones are thin-skinned and transparent. The papillae are discussed at length in Murina (1964b) and measurements are presented in her Table 3. She divided them into three types: rosette-shaped, dome-shaped with crowns, and oval bodies. The most outstanding external feature of this species is the large posterior papillae. Some typical measurements are (length and breadth in microns): 85×75 , 157×91 , 200×114 , 227×200 . They often measure 55–65 μ in height. These measurements are of the same order of magnitude as Murina's oval bodies.

Internally the four retractors are more typically arranged than in the *Golfingia trichocephala* Sluiter complex i.e., the ventral pair is usually larger than the dorsal pair, and both pairs are set off farther from the ventral nerve cord, the dorsals more so than the ventrals. The origin of the retractors generally lies in the posterior third of the body (65–85% of the distance to the posterior end of the trunk) but may be found

farther anterior. The single lobed nephridia are free, sac-shaped, and open at the anterior of the trunk. The bilobed nephridia have a secondary, anterior lobe of varying dimensions (Fig. 3B). The anus is always posterior to the nephridiopores but the distance may vary. One and sometimes two fixing muscles were observed (Murina found up to three). The intestine is fixed to the posterior end of the body by the spindle muscle.

Since submission of the manuscript one specimen from recent collections was found with its introvert completely extended. The 8–10 very small, stubby tentacles are arranged in a cluster off to one side very much like the situation in the genus *Phascolosoma*. The location of the mouth could not be confirmed.

Remarks: This species is closely related to *Golfingia hespera* but differs in four ways. The only external difference is the nature of the papillae. These are larger and more apparent on *G. murinae* and more clustered towards the posterior end while in *G. hespera* they are smaller, more scattered, and sometimes pigmented. Internally the differences are in the nephridia and retractor muscles. The nephridia in *G. hespera* are always bilobed, the two lobes being more or less equal, long, thin lobes. In those *G. murinae* which have two lobes they are not of equal size, one usually significantly shorter than the other. The retractors in *G. murinae* are more typical with the ventral pair larger and both pairs set off farther from the ventral nerve cord with the ventrals being closer to the nerve than the dorsals. This is not the case in *G. hespera*.

In addition to the morphological differences, there are ecological differences which I assume to be real and meaningful. *G. hespera* has been reported from shallow, warm or temperate areas while *G. murinae* comes from deep, cold areas. Their distribution patterns are distinct.

The following two subspecies may represent a dynamic situation in which one form is the ancestral stock, and the other has only recently separated from it. This will be investigated in more detail in the future.

Murina (1964a) has described two *Golfingia* from 395 m in the Northwestern Pacific and several from the Mediterranean (1964b) which she placed in the species *Golfingia hespera*. For reasons discussed elsewhere (Cutler, 1967) it is apparent that Murina's designation was incorrect. Her material represents, in my opinion, two subspecies of a new species which I have named after her in recognition of her contributions to our knowledge of the Sipuncula.

***Golfingia murinae unilobatae* new subspecies**

Diagnosis: Two hundred and one specimens from 35 stations.

This subspecies fits the description of the species but has only the single lobed nephridia. It is generally larger than the other subspecies (4–13 mm), but the size ranges overlap. This form serves as the type for the species. Included in this subspecies would be Murina's (1964a) Pacific specimens of *G. hespera*.

Holotype: U.S.N.M. 38247; Location, 37°13' N, 68°40' W; Depth, 4540 m; collected 25 May 1962 by Sanders et al.

Paratype: U.S.N.M. 38248; Location, 37°13' N, 68°40' W; Depth, 4540 m; collected 25 May 1962 by Sanders et al.

***Golfingia murinae bilobatae* new subspecies**

Diagnosis: Eighty-eight specimens from 22 stations.

Morphologically this subspecies is almost identical with the preceding one. The trunk size is smaller; these range from 2–7 mm as compared with a maximum of 13 mm in the former. As before, the striking feature is the presence of large, mammiform papillae on the posterior end of the trunk. However, there is one internal difference; a small, secondary anterior lobe on the nephridia. If this is absent (3 out of 36) the nephridium is long and slender in contrast to the short, fat one in *G. m. unilobatae*. This by itself may not be just cause for erecting a separate subspecies if it were not for the distinctive distribution pattern of this bilobed form. Murina's (1964b) Mediterranean specimens of *G. hespera* would be included in this subspecies.

Holotype: U.S.N.M. 38249; Location, 24°10' N, 81°22' W; Depth 677 m; collected 1 June 1964 by R. Wigley.

Paratype: U.S.N.M. 38250; Location, 24°10' N, 81°22' W; Depth, 677 m; collected 1 June 1964 by R. Wigley.

Distribution: The distribution of these two subspecies is spatially separate. *G. murinae bilobatae* is found on the continental slope from Cape Hatteras, North Carolina, south to the Florida Keys (34°16' N to 24°10' N) at depths of about 300–700 m. *G. murinae unilobatae* is found from 32°11' to 39°59' N. The most southerly ones are all on the Bermuda Slope between 1000–2000 m. The remainder are at depths between 2200 m and 4750 m on the continental rise between Cape Cod, Massachusetts, and Cape Hatteras, North Carolina.

In summary, this species prefers a relatively cold, stable, deep environment with fine sediments. One subspecies is found in shallower warmer areas with a slightly coarser substratum than the other.

***Golfingia constricticervix* new species**

Diagnosis: A *Golfingia* in the subgenus *Phascoloides* with an unusual neck like constriction and short introvert with large hooks on the distal half from moderately deep, cold water.

Description: Nine specimens from 4 stations.

These are long, slender animals, the length being about 15–20 times the diameter (15 × .67 mm; 5 × .33 mm). They are generally transparent becoming dark yellow towards the two ends of the trunk. The introvert is about 1/5 the length of the trunk (Fig. 4A).

One of the most unique features of this species is a constriction or neck at the base of the introvert. Because of this relatively weak connection, few worms are whole. Those few retaining the introvert show the long

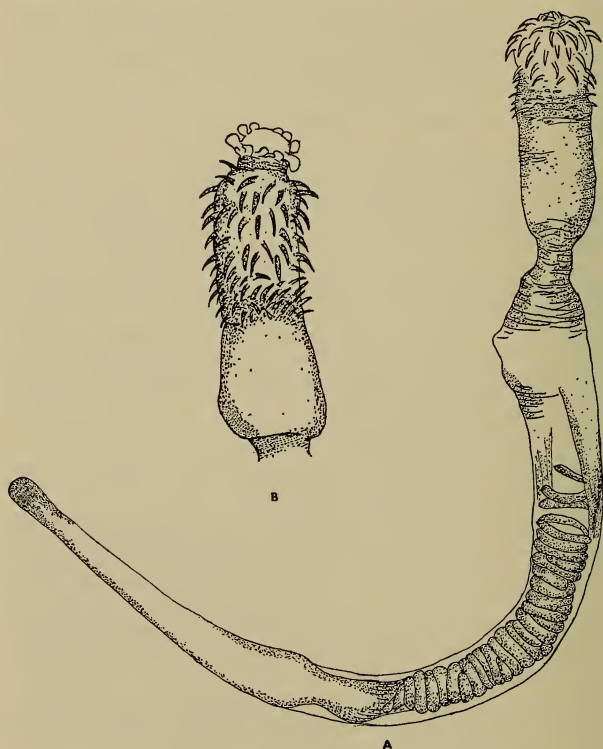


FIGURE 4. Showing *Golfingia* (*Phascoloides*) *constricticervix*: (A) is the entire animal with partially expanded introvert: (B) is completely expanded introvert showing tentacles.

hooks which cover its distal half. The hook size increases from 0.04 mm to 0.28 mm. This marked increase in size towards the tip has not been recorded for other species. The hooks are single pointed, moderately curved, slender, and irregularly arranged. About 12-16 short, reduced tentacles are visible on one individual (Fig. 4B).

The anterior end of the trunk is usually swollen and the anus is located on a small protruberance. Very small, slightly oval, clear, glandular papillae are visible at the anterior and posterior ends of the trunk which is otherwise smooth and thin-walled.

Internally the two retractors originate from the body wall very close to the ventral nerve cord about 15–25 percent of the distance to the posterior end of the trunk. These two muscles join together before leaving the trunk as one unit. The intestinal coil may be loose and the individual coils are often located relatively far apart from one another.

Remarks: This species is similar to *Golfingia vitjazi* Murina, but lacks the round, ribbed, chitinous shield of the anterior end of the trunk. Specimens of *G. constricticervix* were sent to Dr. Murina and she agreed that they were two different species.

These worms are easily identified when the introvert is extended and attached, but if it is withdrawn or broken off, it has a non-descript, non-sipunculan appearance. The specific name refers to the outstanding morphological feature of a constricted “neck” region.

Distribution: This species was found near Bermuda between 1700 m and 4800 m and further north on the continental rise and slope, generally between 1500–3000 m. The temperatures are cold and the sediments quite fine.

Holotype: U.S.N.M. 38246; Location, 33°57' N, 65°47' W; Depth, 4815 m; collected 1 May 1966 by Sanders et al.

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